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GROWTH OF WHITE PINE AND RED SPRUCE TREES AFTER PRUNING

Are pines the only coniferous trees suitable for pruning in the Northeast, or is it feasible to prune red spruce as well? Although red spruce is an important lumber species in the spruce-fir region, it is seldom pruned because of its relatively slow rate of growth.

In the winter of 1951, 127 red spruce and 46 eastern white pine trees were pruned on the Penobscot Experimental Forest near Bangor, Maine.[1] White pine trees scattered throughout the spruce-fir stands afford an opportunity to compare the development of both species under similar conditions. (This report will discuss differences in growth by crown classification over the first 5 years after pruning.)

The crop trees were selected for pruning on the basis of desirable vigor, form, crown class, crown ratio, and size and number of branches. With few exceptions, the trees were pruned to 18 feet to produce one clear 16-foot butt log above the stump. The red spruce trees averaged 6.1 inches and white pine 7.7 inches at time of pruning.

Five growing seasons later, the spruce averaged 6.7 inches and the white pine 8.7 inches, an average growth of 0.65 and 1.0 inches respectively. White pine, which generally has larger limbs and slightly thicker bark than spruce, required an average of 1.3 inches of growth to cover the larger knots completely, as compared to 1 inch for red spruce.

The 5-year growth of the pruned trees was analyzed to see if there was any correlation between growth and their crown class or crown ratio. T. F. McLintock[2] found in an earlier study of unpruned trees that crown ratio and--to a lesser extent--crown class were good criteria for predicting growth of vigorous spruce. (Crown ratio is the percent of the tree in living crown measured to the nearest 10 percent and expressed as a whole number.)

In the present study, the 5-year results indicate that difference in growth between crown classes is not significant at the 5-percent level for pruned red spruce, but is highly significant for pruned white pine (table 1). However, the growth rate of both pine and spruce increased significantly as crown ratios were increased.

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[1] The Penobscot Research Center, Northeastern Forest Experiment Station, and the Forestry Department, University of Maine, cooperated in this study.

[2] Unpublished paper, "A tree classification for red spruce and balsam fir", on file at the Penobscot Research Center, Bangor, Maine.

Table 1.--Increment in relation to crown class and crown ratio

Item	Red spruce		White pine	
	Trees	Average increment	Trees	Average increment
	No.	Inches	No.	Inches
Crown class				
Dominant and codominant	60	0.680	29	1.131
Intermediate	67	.615	17	.765
Total, all trees	127	0.646	46	0.998
Crown ratio				
4	25	0.500	14	0.764
5	74	.638	22	1.009
6	28	.796	10	1.290
Total, all trees	127	0.646	46	0.998

Unless trees grow reasonably fast, the cost of pruning plus interest to the end of the rotation will equal or exceed the increase in wood value resulting from the pruning. It is not known just how fast red spruce should grow in order to return a profit from pruning; no thorough economic study has been made. However, from general considerations of present lumber values, pruning costs, and other pertinent factors, it seems reasonable to assume that a diameter growth rate of at least 0.8 inch per 5-year period is necessary for pruning to show a return.

Although average growth rates of both pine and spruce increased with increasing crown ratios, averages do not tell the whole story because they may include both fast- and slow-growing trees. Among the red spruce, there were 28 trees with a crown ratio of 6; for these trees the average 5-year growth was 0.8 inch (table 1), but only 13 of them or 46 percent actually grew 0.8 inch or more. Of the 102 trees with crown ratios of 5 or higher, only 37 (36 percent) grew 0.8 inch or more. Obviously, crown ratio in red spruce is not very reliable as a guide for selecting individual trees of faster growth rate.

With white pine, the situation was quite different. Of the 29 dominants and codominants, 19 grew better than 1.0 inch in the 5-year period. Half of the 12 intermediates with a crown ratio of 5 or more grew at least 1.0 inch. This indicates that practically any dominant or codominant pines, or intermediates with a crown ratio of 5 or greater, should be acceptable for pruning.

The 5-year growth figures from this study show that pruned red spruce grew only two-thirds as fast as white pine. Nevertheless, some red spruce with long crowns do grow fast enough that they might profitably be pruned. The problem is to identify these fast-growing trees. Further study is necessary to find a more reliable indicator of rapid growth than crown length alone.

--GRANT DAVIS, Research Forester

Penobscot Research Center
Northeastern Forest Experiment Station
Forest Service, U.S. Dept. Agriculture
Bangor, Maine